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(71) Applicant: **HOKKAI CAN CO., LTD.**
No. 2-2, Marunouchi 2-chome
Chiyoda-ku Tokyo(JP)

Applicant: **KIRIN BREWERY COMPANY LTD.**
26-1, Jingumae 6-chome
Shibuya-ku Tokyo-to(JP)

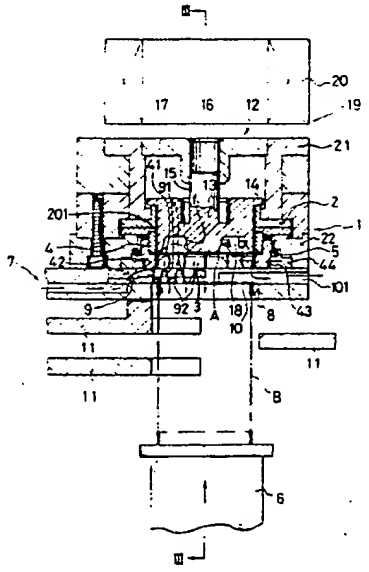
(72) Inventor: **Honma, Tohru**
No. 1367, Nissin 2-chome
Omiya-shi Saitama-ken(JP)
Inventor: **Mori, Shigeki**
No. 1138-18 Shimohayami
Kuki-shi Saitama-ken(JP)
Inventor: **Ohya, Kunihiko**
No. 7-652 Nigatabukuro
Kasukabe-shi Saitama-ken(JP)
Inventor: **Matsumoto, Shiro**
No. 134-1 Minaminakasone
Kasukabe-shi Saitama-ken(JP)
Inventor: **Nakata, Akira**
No. 1528-4, Haraichi
Ageo-shi Saitama-ken(JP)
Inventor: **Abe, Ichiro**
No. 476-3, Morooka-cho Kouhoku-ku
Yokohama-shi Kanagawa-ken(JP)
Inventor: **Hosaka, Naoto**
No. 3-32-22, Koshigoe
Kamakura-shi Kanagawa-ken(JP)

(74) Representative: **Overbury, Richard Douglas et al**
HASELTINE LAKE & CO Hazlitt House 28
Southampton Buildings Chancery Lane
London WC2A 1AT(GB)

(54) Method of and apparatus for introducing inert gas into a can.

(57) The lower edge of the peripheral wall (b) of a can cap (A) and the upper edge of a can barrel (B) are spaced from each other by a gap. Streams of an inert gas from different groups (92, 91) of injector nozzles (9) are injected, from outside of the gap, through the gap into the can cap (A) and the can barrel (B), respectively, to replace air in the can cap (A) and the can barrel (B) with the injected gas. Then the can barrel (B) is fitted in to the can cap (A), and secured thereto to entrap the injected gas in the can barrel (B) and the can cap (A).

FIG.1



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METHOD OF AND APPARATUS FOR INTRODUCING INERT GAS INTO A CAN

BACKGROUND OF THE INVENTION

1. Field of the Invention:

The present invention relates to a method of, and an apparatus for, replacing air in the head space in a can which contains a carbonated beverage or the like, with an inert gas, and enclosing the inert gas in the head space.

2. Description of the Prior Art:

In the canning industry, it has been customary to replace air in the head space in a can with an inert gas such as carbon dioxide gas, nitrogen gas, or the like and enclose the inert gas in the head space in order to prevent the quality of the preserved contents of the can from deteriorating. According to one known method disclosed in Japanese Patent Publication No. 57-29331, the inert gas is injected into the head space in a can barrel filled with contents to replace the air in the head space with the inert gas, and then a can cap is mounted on the can barrel and fixed thereto by seaming.

Fig. 5 of the accompanying drawings shows a can cap A having a circular panel parta and a cylindrical peripheral wall b depending from the entire periphery of the panel part a. The peripheral wall b is fitted over, and soldered, welded, adhered or otherwise secured to, an end of a cylindrical can barrel B which is filled with contents. If the inert gas is introduced into the can of Fig. 5 by a conventional inert gas filling apparatus, then it is necessary to replace the air in the head space in the can barrel B and also in the internal space in the can cap A with the inert gas. It takes a long period of time to replace the air in both spaces with the inert gas even if the amount of inert gas to be injected and the pressure under which the inert gas is to be injected are carefully controlled. Moreover, the injected inert gas tends to fail to reach every corner of the can cap A and the can barrel B.

SUMMARY OF THE INVENTION

In view of the aforesaid drawbacks of the conventional method and apparatus for introducing inert gas into a can, it is an object of the present invention to provide a method of, and apparatus for, replacing air in the head space in the can barrel and in the internal space in the can cap with an inert gas highly efficiently and also for enclosing the inert gas in the can barrel and the can cap.

According to one aspect of the present invention, there is provided a method of introducing an inert gas into a can comprising a can cap having a panel part and a peripheral wall depending from the panel part along the entire periphery of the panel part and a can barrel filled with contents, said method comprising the steps of:
locating a distal edge of the peripheral wall of the can cap and a distal edge of the can barrel so that a gap is provided therebetween;
injecting streams of inert gas from different groups of injector nozzles, located outside said gap, through said gap into said can cap and said can barrel, respectively, to replace air in said can cap and said can barrel with the gas;
fitting the can barrel and the can cap together; and
securing the can barrel and the can cap to each other to entrap the injected gas therein.

According to another aspect of the present invention there is provided an apparatus for introducing an inert gas into a can comprising a can cap having a panel part and a peripheral wall depending from the panel part along the entire periphery of the panel part and a can barrel filled with contents, which apparatus comprises:
can cap holder means for holding the can cap with the panel part uppermost;
a can barrel lifting/lowering device for lifting the can barrel up to a first position in which a gap is provided between an upper edge of the can barrel and a lower edge of the peripheral wall of the can cap held by said can cap holder means, and then for lifting the can barrel up to a second position in which the upper edge of the can barrel is fitted into the peripheral wall of the can cap; and
an inert gas injector having a plurality of injector nozzles located along said gap for injecting an inert gas through said gap into said can cap and said can barrel to replace air in said can cap and said can barrel when said can barrel is in said first position.

The above and other objects, features and advantages of the present invention will become more apparent from the following description when taken in conjunction with the accompanying drawings in which a preferred embodiment of the present invention is shown by way of illustrative example.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a vertical cross-sectional view of an apparatus according to the present invention, showing the manner in which an inert gas is introduced;

Fig. 2 is a view similar to Fig. 1, illustrating the manner in which a can barrel is fitted in a can cap;

Fig. 3 is a cross-sectional view taken along line III-III of Fig. 1;

Fig. 4 is an exploded perspective view of a portion of the apparatus shown in Fig. 1; and

Fig. 5 is a fragmentary perspective view of a can cap and a can barrel which are to be employed in the apparatus of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Figs. 1 to 4 show an apparatus according to the present invention.

The apparatus of the invention employs, as shown in Fig. 5, a can cap A made of a metallic foil d such as an aluminum foil having a thermally fusible layer c of, for example solder or synthetic resin, on its inner surface. A connector e of solder or synthetic resin is mounted on the upper edge of a can barrel B.

As shown in Fig. 1, the apparatus of the invention includes a can cap holder 1 comprising a base tubular member 2 defining a hollow tubular space 201 shaped complementarily to the outer profile of the peripheral wall b of the can cap A, and a presser 4 having an opening 3 disposed concentrically and identical in shape to the hollow tubular space 201, in which opening 3 the peripheral wall b of the can cap A can be fitted. The presser 4 is circumferentially divided into a plurality of segments along the entire lower edge of the base tubular member 2. The presser 4 is resiliently urged radially inwardly towards the centre of the opening 3 by a fastening ring 5 disposed around an upper outer surface thereof.

The presser 4 has on its lower inner surface a radially inwardly projecting land 42 having a curved surface 41 facing radially inwardly. The presser 4 also has an upper inner surface engaging the lower outer surface of the base tubular member 2, by which the presser 4 is prevented from being displaced radially inwardly. The presser 4 has on its lower outer surface a step 43 placed on a guide 44 disposed in a lower portion of a support 22 for allowing the presser 4 to be retracted radially outwardly against the bias of the fastening ring 5.

The apparatus also includes a can barrel lifting/lowering device 6 for supporting the bottom of the can barrel B filled with contents and lifting the open upper edge of the can barrel B from a position below the can cap A held by the can cap holder 1 toward the lower edge of the peripheral wall b of the can cap A. The can barrel lifting/lowering device 6 can be vertically moved by a cam device (not shown). The can barrel lifting/lowering device is elevated by the cam device to lift the can barrel B up to a position in which the upper edge of the can barrel B is spaced by a small gap from the lower surface of the peripheral wall b of the can cap A. Then, an inert gas is introduced from an inert gas injector (described later) through the gap into the inner space in the can cap A and into the head space in the can barrel B to replace the air in these spaces with the introduced inert gas. Thereafter, the can barrel B is further lifted to fit the upper edge thereof into the peripheral wall b of the can cap A to close the can barrel B with the can cap A. Subsequently, the thermally fusible synthetic resin layer c on the inner surface of the peripheral wall b of the can cap A is welded to the outer surface of the upper edge of the can barrel B by a can cap welder (described later), after which the can barrel B and the can cap A are lowered as they are bonded.

The inert gas injector, generally designated at 7, has a tubular member 8 disposed below the opening 3 of the can cap holder 1 for insertion therethrough of an upper portion of the can barrel B. The inert gas injector 7 also includes a plurality of gas injector nozzles 9 defined in the tubular member 8 and opening at the circular inner peripheral surface thereof partly around the small gap to be created between the upper edge of the can barrel B and the lower edge of the peripheral wall b of the can cap A. The inert gas injector nozzles 9 are grouped into a plurality of pairs of adjacent nozzles. One of the nozzles 92 in each pair is oriented to inject the inert gas upwardly into the inner space in the can cap A held by the can cap holder 1, whereas the other nozzle 91 in each pair is directed to inject the inert gas downwardly into the head space in the can barrel B. Therefore, alternate streams of the inert gas are injected into the can cap A and the can barrel B. The injector nozzles 9 are disposed around substantially half of the entire circumference of the gap. The inner peripheral surface of the tubular member 8 has an inert gas discharge hole 10 defined therein in diametrically opposite relation to the injector nozzles 9 for discharging, through a discharge passage 101, excess inert gas which has been injected from the injector nozzles and discharged through the can barrel and the can cap.

A guide device 11 is disposed below the inert gas injector 7 for preventing the can barrel B from tumbling over when the can barrel B is lifted or lowered by the can barrel lifting/lowering device 6.

A can cap pressing device 12 disposed upwardly of the can cap holder 1 includes a panel presser member 13 which is inserted in the base tubular member 2 above the presser 4 of the can cap holder 1. The panel presser member 13 has a flange 14 on its uppermost outer peripheral edge,

the flange 14 being engageable with the upper edge of the base tubular member 2 to limit downward movement of the panel presser member 13. The panel presser member 13 also has a guide member 15 projecting upwardly therefrom and slidably inserted in a guide hole 16 defined in a limit member 17 above the panel presser member 13. Upward movement of the panel presser member 13 is limited when it is engaged by the limit member 17. The panel presser member 13 can be lowered by gravity. The panel presser member 13 has an annular recess 18 defined in the lower surface thereof for receiving legs f projecting from the can cap A shown in Fig. 5.

The can cap welder, generally denoted by 19, comprises a primary high-frequency induction coil 20 and a secondary high-frequency induction coil 21. The secondary high-frequency induction coil 21 is disposed substantially around the can cap pressing device 12, so that the induction coil 21 is located around the position where the can barrel B, lifted by the can barrel lifting/lowering device 6, is fitted into the peripheral wall b of the can cap A held by the can cap holder 1 after the inner space in the can cap A and the head space in the can barrel B have been filled with the inert gas which has been introduced via the gap between the can cap A and the can barrel B.

Operation of the apparatus will now be described below.

As indicated by the chain-dotted lines in Fig.s 1 and 3, the can cap A is fitted in the opening 3 of the can cap holder 1 with the panel part a uppermost by a can cap lifter (not shown), and with the peripheral wall b (which is easily deformed) being temporarily supported as a result of the land 42 of the presser 4 gently abutting against its outer surface Then, as illustrated in Figs 1 and 3, the can barrel B filled with contents is lifted towards the can cap A by the can barrel lifting/lowering device 6 up to the position in which the upper edge of the can barrel B is spaced by a small gap from the lower edge of the peripheral wall b of the can cap A. Thereafter, an inert gas is injected from the injector nozzles 92, 91 of the inert gas injector 7 through the small gap between the can cap A and the can barrel B into the inner space in the can cap A and into the head space in the can barrel B to replace air in these spaces with the inert gas.

Since streams of the inert gas from the injector nozzles 92, 91 are directed at different angles into the internal space in the can cap A and into the head space in the can barrel B, the inert gas is introduced into every corner of these spaces whilst forcing any air out of the spaces through the gap. The charged inert gas fills, and remains in, the spaces in the can cap A and the can barrel B, thus effectively replacing the air in these spaces.

After the air in the can cap A and the can barrel B has been replaced with the introduced gas, the can barrel B is further elevated by the can barrel lifting/lowering device 6 so as to fit into the peripheral wall b of the can cap A with its panel part a pressed down by the panel presser member 13 of the can cap pressing device 12. In the event that the upper edge of the can barrel engages with the lower edge of the peripheral wall b as the can barrel is elevated, the presser 4 can move outwardly against the ring 5 to allow the can barrel to enter the cap and prevent damage to the peripheral wall b. The can barrel B is continuously caused to ascend together with the can cap A while being guided by the base tubular member 2 until the panel presser member 13 reaches its uppermost position shown in Fig. 2, in which the can barrel B is fully fitted into the can cap A.

Then, the primary high-frequency induction coil 20 of the can cap welder 19 is energized to enable the secondary high-frequency induction coil 21, position in radially confronting relation to the peripheral wall b of the can cap A, to induction-heat the metallic foil d on the can cap A and thereby fuse the thermally fusible synthetic resin layer c to the can barrel B.

Thereafter, the can barrel lifting/lowering device 6 is lowered to allow the panel presser member 13 to descend by gravity. The can barrel B sealed by the can cap A is pressed downwardly by the panel presser member 13 and removed from the can cap holder 1.

With the present invention, as described above, the can cap is held by the can cap holder with the panel part thereof uppermost, and the can barrel filled with contents is lifted, from below, towards the can cap by the can barrel lifting/lowering device up to the position in which the lower edge of the peripheral wall of the can cap and the open upper edge of the can barrel are spaced apart from each other by a small gap. Then, the inert gas is injected from the injector nozzles through the small gap into the inner space in the can cap and the head space in the can barrel. Therefore, the inert gas reaches every corner of these spaces, forcing any remaining air out of the spaces through the small gap, and remains in these spaces. Thus, the introduced inert gas efficiently replaces the air in the spaces. The can barrel is continuously elevated by the can barrel lifting/lowering device so that the can barrel is immediately fitted into the can cap after the inert gas has been injected.
Consequently, the injected gas is reliably entrapped or enclosed in the can barrel and the can cap which are assembled together.

Although a certain preferred embodiment has been shown and described, it should be understood that many changes and modifications may

be made therein without departing from the scope of the invention as defined in the appended claims.

Claims

1. A method of introducing an inert gas into a can comprising a can cap (A) having a panel part (a) and a peripheral wall (b) depending from the panel part along the entire periphery of the panel part and a can barrel (B) filled with contents, said method comprising the steps of:
locating a distal edge of the peripheral wall of the can cap and a distal edge of the can barrel so that a gap is provided therebetween;
injecting streams of inert gas from different groups (92, 91) of injector nozzles (9) located outside said gap, through said gap into said can cap and said can barrel, respectively, to replace air in said can cap and said can barrel with the gas;
fitting the can barrel and the can cap together; and
securing the can barrel and the can cap to each other to entrap the injected gas therein.

2. An apparatus for introducing an inert gas into a can comprising a can cap (A) having a panel part (a) and a peripheral wall (b) depending from the panel part along the entire periphery of the panel part and a can barrel (B) filled with contents, which apparatus comprises:
can cap holder means (1) for holding the can cap with the panel part uppermost;
a can barrel lifting/lowering device (6) for lifting the can barrel up to a first position in which a gap is provided between an upper edge of the can barrel and a lower edge of the peripheral wall of the can cap held by said can cap holder means, and then for lifting the can barrel up to a second position in which the upper edge of the can barrel is fitted into the peripheral wall of the can cap; and
an inert gas injector (7) having a plurality of injector nozzles (9) located along said gap for injecting an inert gas through said gap into said can cap and said can barrel to replace air in said can cap and said can barrel when said can barrel is in said first position.

3. An apparatus according to claim 2, wherein said injector nozzles (9) include a group of injector nozzles (91) for injecting the inert gas into said can barrel and another group of injector nozzles (92) for injecting the inert gas into said can cap.

4. An apparatus according to claim 2 or 3, wherein said inert gas injector (7) has an inert gas discharge hole (10) disposed in opposite relation to said injector nozzles (9) for discharging excess inert gas from said can barrel and said can cap.

5. An apparatus according to claim 2, 3 or 4, wherein said can cap holder means (1) comprises a presser (4) for resiliently holding the peripheral wall of the can cap radially inwardly, a base tubular member (2) concentric with said presser (4) for guiding upward movement of said can cap as the can barrel is lifted to its second position, and a vertically movable presser member (13) slidably disposed in said base tubular member (2) for limiting upward movement of the panel part of the can cap in said base tubular member.

6. An apparatus according to claim 2, 3, 4 or 5 wherein the apparatus further comprises a can cap welder (19) having heating means (21) disposed around the peripheral wall of the can cap when the can barrel is in said second position, for heating a thermally fusible adhesive layer (c,e) on an inner surface of the peripheral wall of the can cap or on an outer surface of the upper edge of the can barrel.

7. An apparatus according to claim 6, wherein said can cap includes a metallic material (d) and said heating means comprising an induction heater (21).

FIG. 1

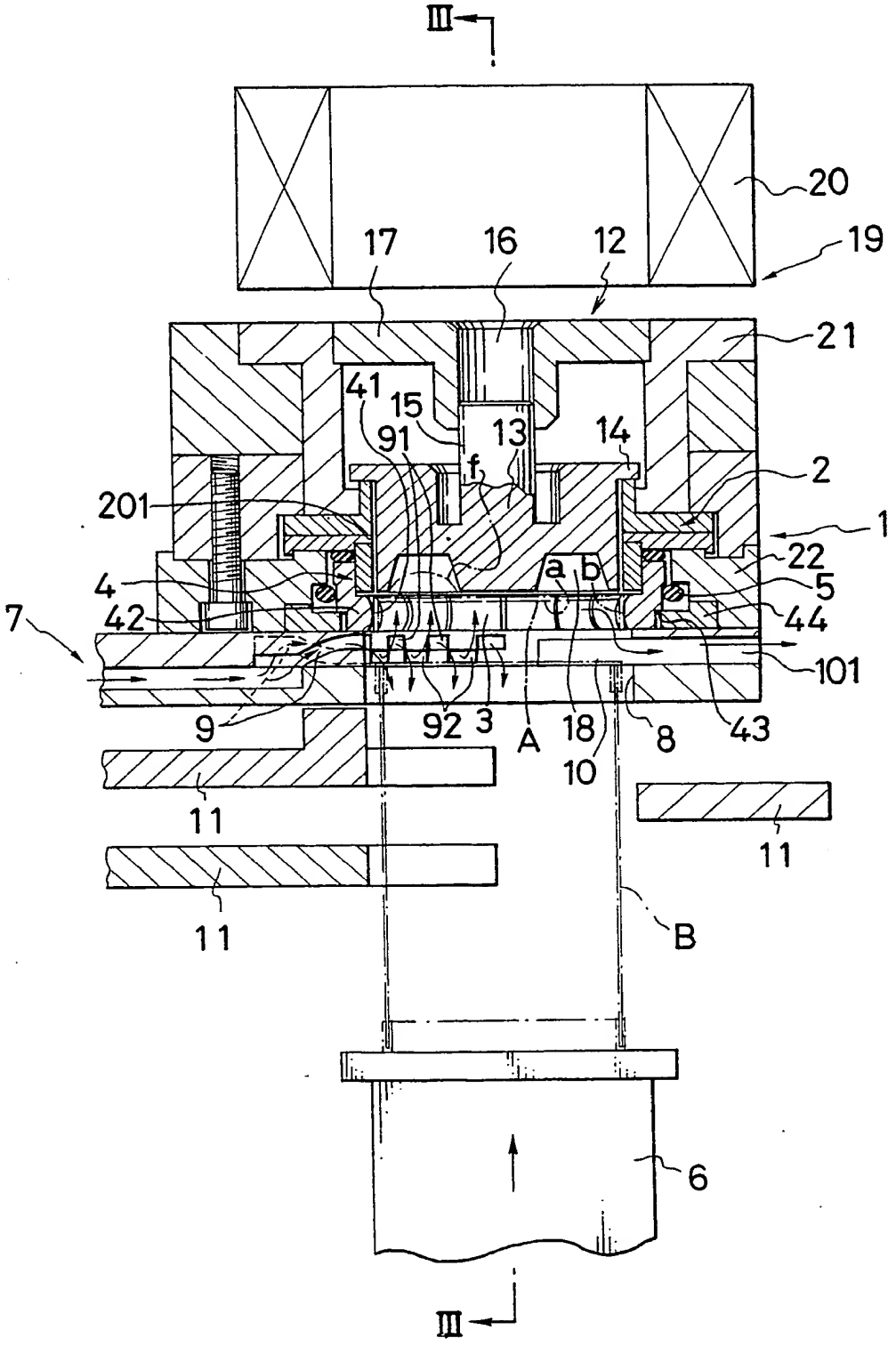


FIG.2

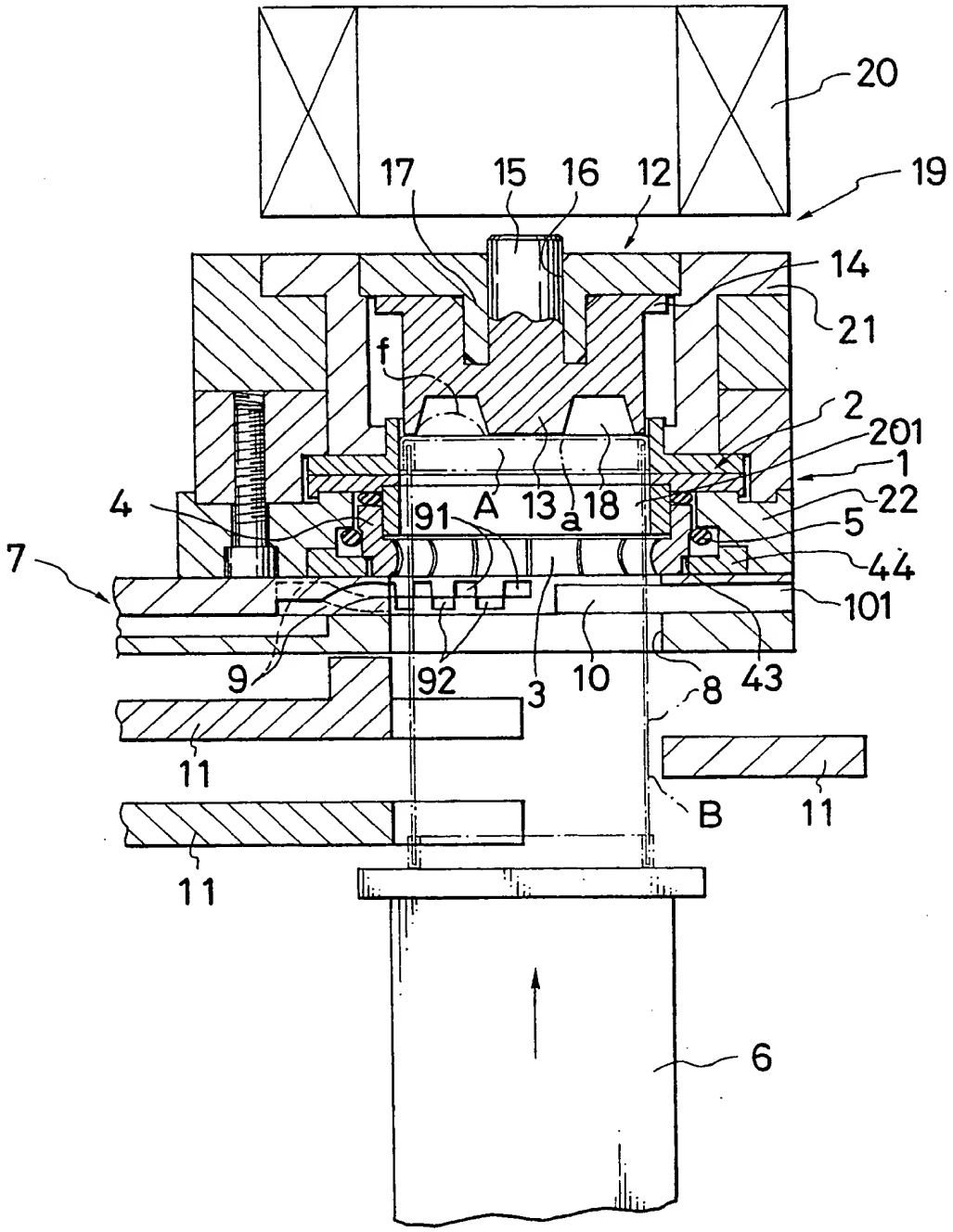
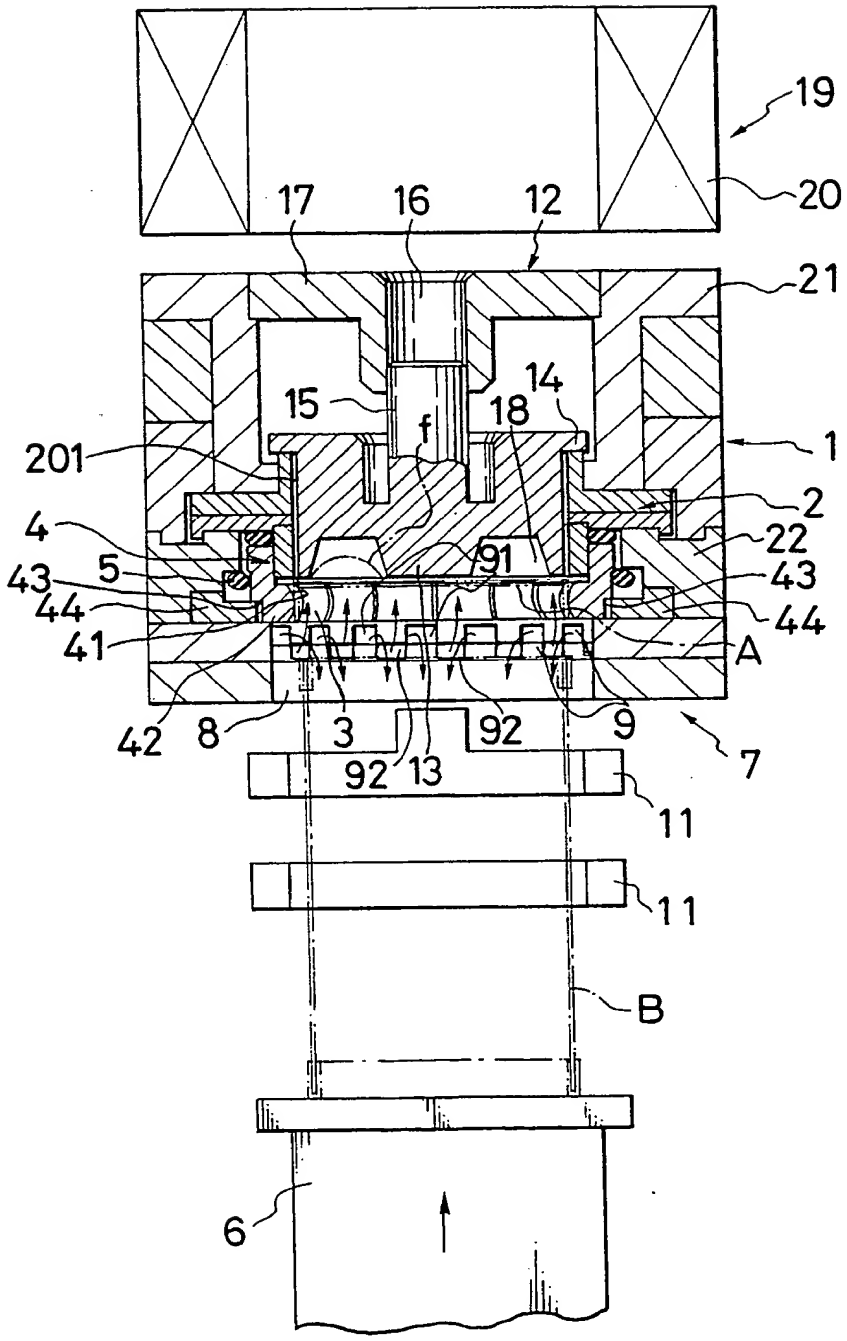


FIG.3



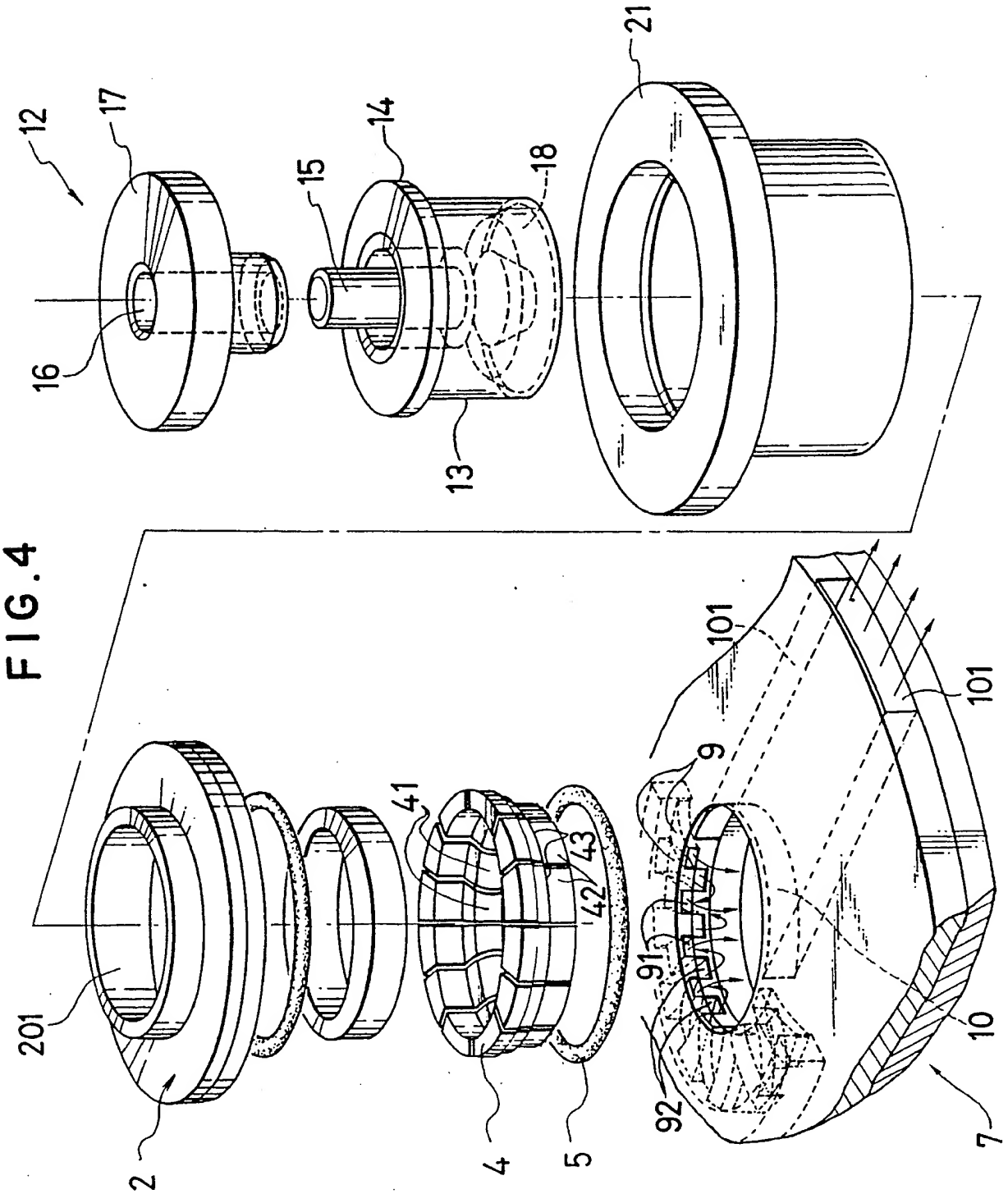
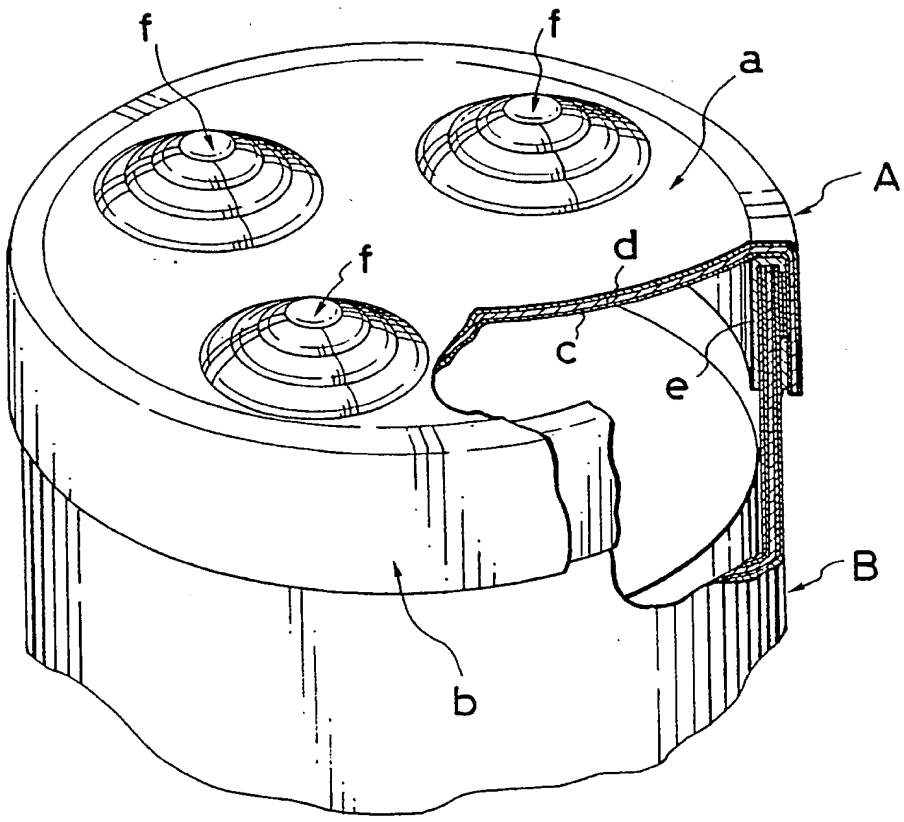


FIG.4

FIG.5



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EUROPEAN SEARCH REPORT

Application Number

EP 88 30 6955

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	US-A-3 246 447 (SMITH et al.) * Whole document *	1-3	B 67 B 3/00 B 65 B 31/04 B 65 B 7/28
Y		4,6,7	
Y	DE-A-3 640 693 (THE COCA-COLA CO.) * Figures 3A,3B; column 7, lines 20-47 *	4	
Y	DE-A-3 000 991 (SUPIK) * Figure 3; page 12, line 14 - page 13, line 16 *	6,7	
X	EP-A-0 214 372 (R. BOSCH GmbH) * Figures 1-6; claims 1,4 *	1,2	
X	DE-B-1 119 700 (HOLSTEIN & KAPPERT) * Whole document *	1,2	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

B 67 C
B 67 B
B 65 B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	02-03-1989	DEUTSCH J.P.M.

CATEGORY OF CITED DOCUMENTS

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